ABL/ABLH9000 Series Stage
User's Manual

P/N: EDS104 (Revision 1.01.00)

Dedicated to the Science of Motion
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Chapter 1: Overview

This manual describes Aerotech's ABL/ABLH9000 series of air bearing positioning stages. Figure 1-1 shows a typical ABL9000 positioning stage.

The ABL/ABLH9000 series supports travel distances ranging up to 1m x 1m. Designed to meet the exacting requirements of wafer, flat panel display, and optical inspection and fabrication, the ABL/ABLH9000 sets new standards of performance.

This chapter introduces standard and optional features of the ABL/ABLH9000 stages and gives general safety precautions.

Figure 1-1: Typical ABL/ABLH9000 Series Positioning Stage

NOTE: Aerotech continually improves its product offerings, and listed options may be superseded at any time. Refer to the most recent edition of the Aerotech Motion Control Product Guide for the most current product information at www.aerotech.com.

1.1. Standard Features

The ABL/ABLH9000 series stages all incorporate completely non-contact air bearing surfaces, linear motors, and feedback devices to provide a maintenance free stage. There is no mechanical contact to wear or require lubrication, making these stages ideal for clean room and medical applications.

The ABL/ABLH9000 incorporates an active preload on both vertical and horizontal surfaces. The opposing thin-film pressure maintains the bearing nominal gap tolerance. This design, in addition to the large air-bearing surface that distributes the load over a large surface area, results in a stage with outstanding stiffness that is ideal for heavy or offset loading.

The brushless linear motor uses an ironless forcer, which means there is zero cogging and no attractive forces – resulting in unsurpassed smoothness of motion. This is especially useful in applications where velocity control is important.

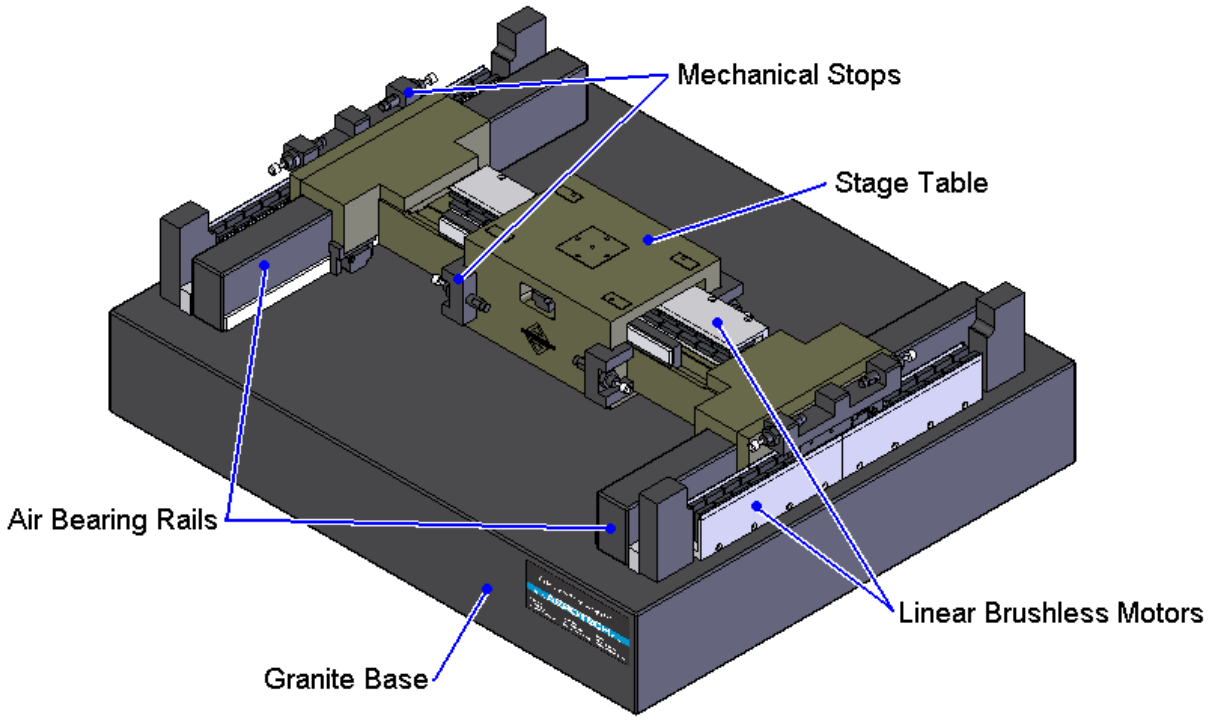

Figure 1-2: ABL/ABLH9000 Series Stage

1.1.1. Optional Features

The ABL/ABLH9000 can be readily customized to meet the needs of individual applications. Common examples include cable management for stage-mounted payloads, custom tabletops, and granite bases. Contact the Aerotech factory for more details.

Table 1-1: Model Numbers and Ordering Options

ABL/ABLH9000 Series Linear Air-Bearing Stage
There are no standard options. Please contact the factory.

1.2. Safety Procedures and Warnings

The following statements apply throughout this manual. Failure to observe these precautions could result in serious injury to those performing the procedures and damage to the equipment.

This manual and any additional instructions included with the stage should be retained for the lifetime of the stage.

	To minimize the possibility of electrical shock and bodily injury or death, disconnect all electrical power prior to making any electrical connections.
	To minimize the possibility of electrical shock and bodily injury or death when any electrical circuit is in use, ensure that no person comes in contact with the circuitry when the stage is connected to a power source.
	To minimize the possibility of bodily injury or death, disconnect all electrical power prior to making any mechanical adjustments.
	Moving parts of the stage can cause crushing or shearing injuries. All personnel must remain clear of any moving parts.
	Improper use of the stage can cause damage, shock, injury, or death. Read and understand this manual before operating the stage.
	If the stage is used in a manner not specified by the manufacturer, the protection provided by the stage can be impaired.
	Stage cables can pose a tripping hazard. Securely mount and position all stage cables to avoid potential hazards.

	Do not expose the stage to environments or conditions outside the specified range of operating environments. Operation in conditions other than those specified can cause damage to the equipment.
	The stage must be mounted securely. Improper mounting can result in injury and damage to the equipment.
	Use care when moving the stage. Manually lifting or transporting stages can result in injury.
	Only trained personnel should operate, inspect, and maintain the stage.
	This stage is intended for light industrial manufacturing or laboratory use. Use of the stage for unintended applications can result in injury and damage to the equipment.
	Before using this stage, perform an operator risk assessment to determine the needed safety requirements.

1.3. EC Declaration of Incorporation

Manufactorer: Aerotech, Inc.
101 Zeta Drive
Pittsburgh, PA 15238
USA

herewith declares that the product:

Aerotech, Inc. ABL/ABLH9000 Stage

is intended to be incorporated into machinery to constitute machinery covered by the Directive 2006/42/EC as amended;

does therefore not in every respect comply with the provisions of this directive;

and that the following harmonized European standards have been applied:

EN ISO 12100-1,-2:2003+A1:2009
Safety of machinery - Basic concepts, general principles for design
ISO 14121-1:2007
Safety of machinery - Risk assessment - Par 1: Principles
EN 60204-1:2005
Safety of machinery - Electrical equipment of machines - Part 1: General requirements

and further more declares that

it is not allowed to put the equipment into service until the machinery into which it is to be incorporated or of which it is to be a component has been found and declared to be in conformity with the provisions of the Directive 2006/42/EC and with national implementing legislation, i.e. as a whole, including the equipment referred to in this Declaration.

Authorized Representative: Manfred Besold
Address: AEROTECH GmbH
Süd-West-Park 90
D-90449 Nürnberg

Name: Alex Weibel /
Position: Engineer Verifying Compliance
Location: Pittsburgh, PA
Date: February 28, 2011

Chapter 2: Installation

This chapter describes the installation procedure the ABL/ABLH9000 stage, including handling the stage properly, securing the stage to the mounting surface, attaching the payload, and making the electrical connections.

Installation must follow the instructions in this chapter. Failure to follow these instructions could result in injury and damage to the equipment.

2.1. Unpacking and Handling the Stage

Carefully remove the stage from the protective shipping container. Before operating the stage, it is important to let the stage to stabilize at room temperature for at least 12 hours. It is important to clean the stage by blowing it off with pressurized nitrogen or clean, oil-less air. If the granite surfaces need cleaned, they can be cleaned with a waterless granite cleaner available from most granite suppliers.

Before the stage can be operated, the shipping clamps must be removed. These are the only red anodized parts on the stage and must all be removed.

To lift the stage, use a forklift and lift the granite from below. There are typically threaded inserts in the sides of the granite block, but they should only be used for lifting if absolutely necessary. Consult the factory for more details on lifting if a forklift is unavailable.

Each stage has a label listing the system part number and serial number. These numbers contain information necessary for maintaining or updating system hardware and software. Locate this label and record the information for later reference. If any damage has occurred during shipping, report it immediately.

Do not attempt to move the stage until the air supply, detailed in Section 2.6. , has been installed. Moving the stage table without air supplied can cause permanent damage to the stage.

Do not manually lift or transport the stages.

2.2. Preparing the Mounting Surface

The ABL/ABLH9000 is supplied on its own granite base. This base should be supported on a non-influencing 3-point mount or other suitable isolation system. Contact the factory for detailed assistance.

2.3. Securing the Stage to the Mounting Surface

All ABL/ABLH9000 stages come mounted to a granite slab from the factory. This granite is not only a part of the air bearing system, but also eliminates the need for a customer-prepared flat mounting surface. The mounting scheme of the granite base will depend on stage size and configuration. Consult the documentation delivered with the stage or the factory for more details on mounting.

2.4. Attaching the Payload to the Stage

To prevent damage to payloads, test the operation of the stage before the payload is attached to the stage table. Proceed with the electrical installation and test the motion control system in accordance with the system documentation. Document all results for future reference. For information on electrical connections, refer to Section 2.5. and the documentation delivered with the stage.

The payload should be flat, rigid, and comparable to the stage in quality.

NOTE: For valid system performance, the mounting interface should be flat within 1 µm per 50 mm.

2.5. Electrical Installation

Stages come from the factory completely wired and assembled. Due to the custom nature of the ABL/ABLH9000 series stages, there is no standard wiring procedure. Each ABL/ABLH9000 stage is shipped with documentation regarding the stage wiring, controller interface connectors, and specs for each particular stage.

Never connect or disconnect any electrical component or connecting cable while power is applied, or serious damage can result.

2.6. Air Requirements

The air and vacuum supplies to the air bearing are important for the operation of the system. If compressed air is used, it must be filtered to 0.25 microns, dry to 0ºF dewpoint, and oil free. If nitrogen is used, it must be 99.99% pure and filtered to 0.25 microns. Air pressure of 80 psi, ±5 psi, is necessary for use. Air should be supplied via a 1/4" OD (1/8" ID) polyurethane air hose. It is recommended that a pressure switch is installed to remove power from the air bearing if pressure drops below 40 psi because the bearing surfaces could be damaged. Vacuum requirements are between 20" Hg and 24" Hg (approx. 1/8 hp pump). The stage can be run without vacuum, but accuracy will be severely affected.

An air flow rate of .65 CFM at 80 psi should be observed, as well as a vacuum flow rate of .23 CFM at 22" Hg.

Chapter 3: Operating Specifications

This chapter contains general technical information about ABL/ABLH9000 series stages. Included are basic product specifications and general information on limit switches and motor wiring.

3.1. Environmental Specifications

The environmental specifications for the ABL/ABLH9000 are listed in the following table.

Table 3-1: Environmental Specifications

Ambient Temperature	Operating: 16° to 25° C (61° to 77° F) The optimal operating temperature is 20° C ±2° C (68° F ±4° F). If at any time the operating temperature deviates from 20° C degradation in performance could occur. Contact Aerotech for information regarding your specific application and environment.
	Storage: 0° to 40° C (32° to 104° F) in original shipping packaging
Humidity	Operating: 40 percent to 60 percent RH The optimal operating humidity is 50 percent RH.
	Storage: 30 percent to 60 percent RH, non-condensing in original packaging
Altitude	Operating: 0 to 2,000 m (0 to 6,562 ft) above sea level Contact Aerotech if your specific application involves use above 2,000 m or below sea level.
Vibration	Use the system in a low vibration environment. Excessive floor or acoustical vibration can affect stage and system performance. Contact Aerotech for information regarding your specific application.
Dust Exposure	The ABL/ABLH9000 stages are not suited for dusty or wet environments. This equates to an ingress protection rating of IP00.
Use	Indoor use only

Do not expose the stage to environments or conditions outside the specified range of operating environments. Operation in conditions other than those specified can cause damage to the equipment.

3.2. Basic Specifications

Basic ABL/ABLH9000 series positioning stage specifications are shown in Table 3-2. Motor specifications are shown in Table 3-4.

Table 3-2: ABL/ABLH9000 Series Specifications

Basic Model		ABL90300-300	ABL90500-500
Total Travel		300 mm x 300 mm	500 mm x 500 mm
Drive System		Linear Brushless Servomotor (Bridge Axis: BLM-142-A, Gantry Axis: BLM-142-A)	
Feedback		Noncontact Linear Encoder (LN) or Laser Interferometer (LZR)	
Resolution		1 nm - 1.0 µm	
Maximum Travel Speed(1)		500 mm/s	
Maximum Linear Acceleration (no load)		1 g - 10 m/s^2	
Maximum Load(2)		30.0 kg	
Accuracy (3)	LN	±0.5 µm	±0.75 µm
	LZR	Standard ±10 ppm; Compensated ±1.5 ppm(4)	Contact Aerotech for further details
Repeatability(3)	LN	±0.1 µm	
Straightness and Flatness(5)	Maximum Deviation	±0.50 µm	±1.5 µm
Pitch/Roll/Yaw		2 arc sec	3.5 arc sec
Stage Mass		320 kg	690 kg
Moving Mass	Bridge	9.5 kg	
	Gantry	44.0 kg	57.0 kg
Orthogonality		2 arc sec	3 arc sec
Operating Pressure(6)		551.6 kPa + 0, -34 kPa	
Air Consumption(7)		45 SLPM	
Material(8)		Aluminum	
Finish		Hard Coating (62 Rockwell Hardness Teflon® Impregnated)	

(1) Maximum speed based on stage capability; maximum application velocity may be limited by system data rate and system resolution.
(2) Maximum load based on bearing capability; maximum application load may be limited by acceleration requirements.
(3) Requires Aerotech controllers and HALAR Calibration option.
(4) Requires environmental compensation.
(5) Requires HALSF option
(6) To protect air bearing against under-pressure, an in-line pressure switch tied to controller E-stop input is recommended.
(7) Air supply must be clean, dry to 0° F dewpoint and filtered to 0.25 µm or better; recommend nitrogen at 99.9% purity.
(8) Optional construction materials include ceramic, invar, stainless, and titanium.
(9) Specifications are for single-axis systems, measured 50 mm above the tabletop. Performance of multi-axis systems is payload and workpoint dependent. Consult factory for multi-axis or non-standard applications.

Table 3-2: ABL/ABLH9000 Series Specifications (continued)

Basic Model		ABLH90750-750	ABLH91000-1000	ABLH91200-1200
Total Travel		750 mm x 750 mm	1000 mm x 1000 mm	1200 mm x 1200 mm
Drive System		Linear Brushless Servomotor (Bridge Axis: BLM-325-A, Gantry Axis: BLMH-262-A)		
Feedback		Noncontact Linear Encoder (LN) or Laser Interferometer (LZR)		
Resolution		1 nm - 1.0 µm		
Maximum Travel Speed(1)		500 mm/s		
Maximum Linear Acceleration (no load)		1 g - 10 m/s^2		
Maximum Load(2)		125.0 kg		
Accuracy (3)	LN	±0.85 µm	±1.0 µm	±1.25 µm
	LZR	Contact Aerotech for further details		
Repeatability(3)	LN	±0.2 µm		
Straightness and Flatness(5)	Maximum Deviation	±2.0 µm	±2.5 µm	±1.5 µm
Pitch/Roll/Yaw		4.5 arc sec	5.5 arc sec	6 arc sec
Stage Mass		3200.0 kg	4130.0 kg	5200.0 kg
Moving Mass	Bridge	35.0 kg		
	Gantry	120.0 kg	130.0 kg	140.0 kg
Orthogonality		3.5 arc sec	4 arc sec	5 arc sec
Operating Pressure(6)		551.6 kPa + 0, -34 kPa		
Air Consumption(7)		85 SLPM		
Material(8)		Aluminum		
Finish		Hard Coating (62 Rockwell Hardness Teflon® Impregnated)		

(1) Maximum speed based on stage capability; maximum application velocity may be limited by system data rate and system resolution.
(2) Maximum load based on bearing capability; maximum application load may be limited by acceleration requirements.
(3) Requires Aerotech controllers and HALAR Calibration option.
(4) Requires environmental compensation.
(5) Requires HALSF option
(6) To protect air bearing against under-pressure, an in-line pressure switch tied to controller E-stop input is recommended.
(7) Air supply must be clean, dry to 0° F dewpoint and filtered to 0.25 µm or better; recommend nitrogen at 99.9% purity.
(8) Optional construction materials include ceramic, invar, stainless, and titanium.
(9) Specifications are for single-axis systems, measured 50 mm above the tabletop. Performance of multi-axis systems is payload and workpoint dependent. Consult factory for multi-axis or non-standard applications.

Table 3-3: ABL/ABLH9000 Series Resolution Information

Code	Signal Period	Travel/Step	Multiplier	Maximum Speed
LN	4 µm	0.004 µm - 1.2 µm	Requires External	System Data Rate
LZR	316.5 µm	79nm	Integral λ/8	500 mm/s(1)
LZR	316.5 µm	.3nm - 15.8nm	Requires External	System Data Rate

Code	Maximum Speed	Signal Type	Encoder Connector
LN	System Data Rate		
LZR	500 mm/s(1)		
LZR	System Data Rate		

1. Requires system data rate of at least 14 MHz

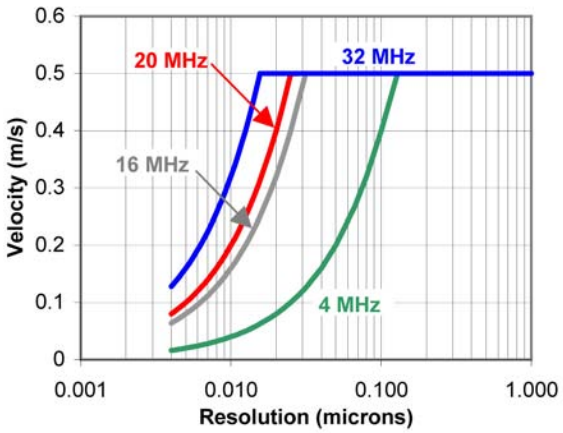

Figure 3-1: Velocity vs. resolution as a function of system data rate (ABL/ABLH9000 with LTAS or LNAS encoder)

Table 3-4: ABL/ABLH9000 Motor Specifications

Model		BLM-142	BLM-325	BLMH-262
Winding Designation		-A	-A	-A
Performance Specifications (1,5)				
Continuous Force, 20 psi, 1.4 bar (2)	N	134.2	257.5	437.1
	lb	30.2	57.9	98.3
Continuous Force, No Cooling (2)	N	85.6	178.8	266.2
	lb	19.3	40.2	59.9
Peak Force (3)	N	537.0	1029.9	1748.6
	lb	120.7	231.6	393.1
Electrical Specifications (5)				
BEMF Constant (line to line, max)	V / m / sec	31.75	41.11	64.42
	V / in / sec	0.81	1.04	1.64
Continuous Current, 20 psi, 1.4 bar (2)	A, pk	4.86	7.20	7.80
	A, rms	3.44	5.09	5.52
Continuous Current, No Cooling (2)	A, pk	3.10	5.00	4.75
	A, rms	2.19	3.54	3.36
Peak Current, Stall (3)	A, pk	19.44	28.80	31.20
	A, rms	13.75	20.36	22.06
Force Constant, Sinusoidal Drive (4,8)	N / A, pk	27.62	35.76	56.04
	lb/A, pk	6.21	8.04	12.60
	N / A, rms	39.06	50.57	79.26
	lb / A, rms	8.78	11.37	17.82
Motor Constant (2,4)	N / √W	8.16	13.69	20.24
	lb / √W	1.84	3.08	4.55
Resistance, 25 °C (line to line)	Ohms	10.9	6.5	7.3
Inductance (line to line)	mH	8.70	5.20	4.60
Thermal Resistance, 20 psi, 1.4 bar	°C / W	0.37	0.28	0.21
Thermal Resistance, No Cooling	°C / W	0.91	0.59	0.58
Maximum Bus Voltage	VDC	340	340	340

(1) Performance is dependent upon heat sink configuration, system cooling conditions, and ambient temperature
(2) Values shown @ 100 °C rise above a 25 °C ambient temperature, with motor mounted to the specified aluminum heat sink
(3) Peak force assumes correct rms current, consult Aerotech
(4) Force Constant and Motor Constant specified at stall
(5) All performance and electrical specifications +/- 10%
(6) Maximum winding temperature is 125 °C
(7) Ambient operating temperature range: 0 °C - 25 °C, consult Aerotech for performance in elevated ambient temperatures
(8) All Aerotech amplifiers are rated Apk; use torque constant in N-m / Apk when sizing

3.3. Load Capability [TBD]

3.4. Limit Switch Wiring

ABL/ABLH9000 series stages are provided with a series of optical limit switch assemblies. The limit switches signal when the stage has reached its maximum useable travel distance in all directions.

3.4.1. Limit Switch Operation

Each limit switch has a light source and detector mounted to a small printed circuit board. Each limit switch board is mounted at the ends of an axis with their emitter–detector axes perpendicular to the direction of axis motion. The limit switch itself can be configured as normally closed (NC) or normally open (NO).

If the stage is driven approximately 6 mm beyond the electrical limit, it will encounter a mechanical stop. Although the operating speed of the stage may be relatively slow, damage to the stage could result.

3.4.2. Limit Switch Wiring

Limit switches are open-collector, TTL–compatible, electro–optical devices powered by 5 Volts that change output states when the stage approaches its maximum travel distance and breaks the light beam. Since they are open-collector devices, they may be interfaced to 24Volt logic inputs. Each limit switch is mounted on a small printed circuit board. Standard ABL/ABLH9000 Stages include limit switch wiring integrated into the feedback connector.

Assuming a NC limit configuration, the input to the controller is seen as a logic 0 (typical 0.4V @ 12.8mA) when no limit condition is present. When the limit switch is activated, a 5V source through a pull-up resistor causes a logic 1 (typically 4.8-5V) to be seen by the controller input. The limit switch operation for a NO limit configuration is the exact opposite as described above. See Figure 3-2 for a diagram of limit switch wiring.

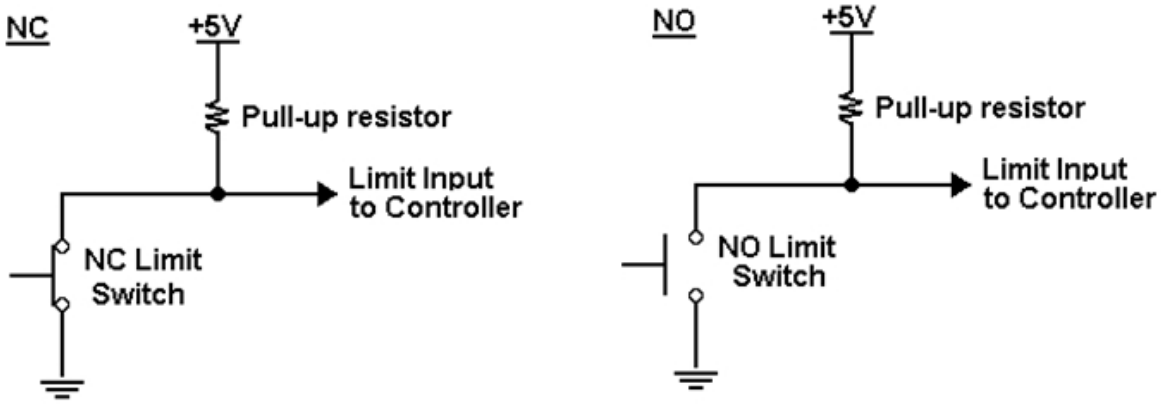

Figure 3-2: Normally Closed (NC) and Normally Open (NO) Limit Switch Wiring

3.5. Standard Motor Wiring

Stages come from the factory completely wired and assembled. Due to the custom nature of the ABL/ABLH9000 series stages, there is no standard wiring procedure. Each ABL/ABLH9000 stage is shipped with documentation regarding the stage wiring, controller interface connectors, and specs for each particular stage.

NOTE: Refer to the other documentation accompanying your Aerotech equipment. Call your Aerotech representative if there are any questions on system configuration.

3.6. Vacuum Operation

The ABL/ABLH9000 is an air-bearing stage and is not compatible with operation in a vacuum environment. Contact Aerotech for alternate solutions.

Chapter 4: Maintenance

The ABL/ABLH9000 series stages are designed to be maintenance free positioning systems. Due to the non-contact air bearing design, there are no friction surfaces or dynamic seals to wear or require lubrication. However, it is important to clean the bearing surfaces and encoder strips to maintain the accuracy of the stage. This chapter will detail the cleaning process and specify recommended cleaning solvents.

NOTE: The bearing area must be kept free of foreign matter and moisture; otherwise, the performance and life expectancy of the stage will be reduced. See Section 2.6. for air requirements.

To minimize the possibility of bodily injury, confirm that all electrical power is disconnected prior to making any mechanical adjustments.

4.1. Service and Inspection Schedule

Aerotech recommends that the ABL/ABLH9000 be inspected once per month until a trend develops for the specific application and environment.

4.2. Cleaning and Lubrication

There are no elements on the ABL/ABLH9000 that require lubrication. Periodic cleaning to remove dust is recommended.

4.2.1. Recommended Cleaning Solvents

Before using a cleaning solvent on any part of the stage, it is recommended that clean, dry compressed air is used to blow away small particles and dust. All encoder surfaces and magnet tracks should be cleaned with isopropyl alcohol. Aluminum hardcoated metal surface may be cleaned with acetone. Acetone should not be used on magnet tracks because it could break down the epoxy that holds the magnets in place.

Table 4-1: Recommended Cleaning Solvents

Item	Recommended Cleaner
Encoders, Magnets	Isopropyl Alcohol
Hardcoded Aluminum	Acetone
Granite	Waterless Window Cleaner*
*One example is Tru Clean, available through Tru-Stone Technologies	

4.2.2. Cleaning Process

It is recommended that all air bearing and encoder surfaces are cleaned often to prevent damage to the stage or decreased performance. The entire stage should be blown with clean, dry, compressed air often to prevent dust from building up in the linear motors, encoders, and air bearing surfaces. Due to the non-contact design, these surfaces operate very close together, allowing dust to easily buildup and cause damage.

In order to clean the encoder strips, move the stage to one extreme corner of travel. Remove power to the stage and carefully wipe the strips with a clean, lint-free cloth soaked in isopropyl alcohol. Once the solvent has all dried, restore power, move the stage to the opposite extreme corner of travel, and repeat the process. In most cases, this will allow the entire encoder strip to be accessed for cleaning.

The cleaning process for the granite faces will differ depending on the type of cleaner purchased. Follow instructions on the container for specific details. In order to access the entire length of the granite air bearing surfaces, it will be necessary to move the stage. Begin with the stage at one extreme corner of travel and remove power. Clean all accessible granite surfaces, and once the cleaner has dried, restore power and move the stage to the opposite extreme corner of travel. This should expose all previously covered granite surface. Repeat the cleaning process, and then restore power to the stage once all solvents have dried.

The process for cleaning magnet tracks, metal air bearing surfaces, and other parts of the stage is very similar with the exception of the solvent used. In order to clean entire surfaces, it may be necessary to move the stage to several different positions.

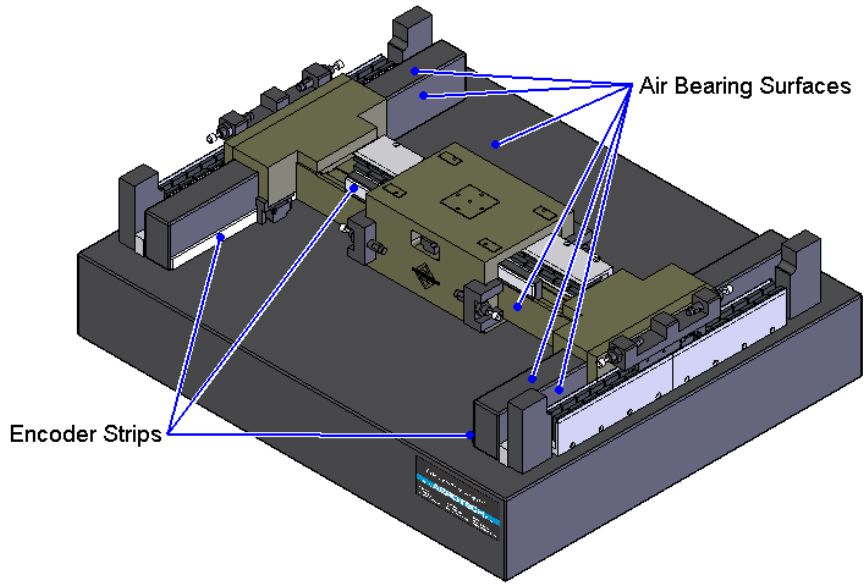

Figure 4-1: Air Bearing Surfaces and Encoder Scales Require Periodic Cleaning

Appendix A: Warranty and Field Service

Aerotech, Inc. warrants its products to be free from defects caused by faulty materials or poor workmanship for a minimum period of one year from date of shipment from Aerotech. Aerotech's liability is limited to replacing, repairing or issuing credit, at its option, for any products that are returned by the original purchaser during the warranty period. Aerotech makes no warranty that its products are fit for the use or purpose to which they may be put by the buyer, where or not such use or purpose has been disclosed to Aerotech in specifications or drawings previously or subsequently provided, or whether or not Aerotech's products are specifically designed and/or manufactured for buyer's use or purpose. Aerotech's liability or any claim for loss or damage arising out of the sale, resale or use of any of its products shall in no event exceed the selling price of the unit.

Laser Products

Aerotech, Inc. warrants its laser products to the original purchaser for a minimum period of one year from date of shipment. This warranty covers defects in workmanship and material and is voided for all laser power supplies, plasma tubes and laser systems subject to electrical or physical abuse, tampering (such as opening the housing or removal of the serial tag) or improper operation as determined by Aerotech. This warranty is also voided for failure to comply with Aerotech's return procedures.

Return Procedure

Claims for shipment damage (evident or concealed) must be filed with the carrier by the buyer. Aerotech must be notified within (30) days of shipment of incorrect materials. No product may be returned, whether in warranty or out of warranty, without first obtaining approval from Aerotech. No credit will be given nor repairs made for products returned without such approval. Any returned product(s) must be accompanied by a return authorization number. The return authorization number may be obtained by calling an Aerotech service center. Products must be returned, prepaid, to an Aerotech service center (no C.O.D. or Collect Freight accepted). The status of any product returned later than (30) days after the issuance of a return authorization number will be subject to review.

Returned Product Warranty Determination

After Aerotech's examination, warranty or out-of-warranty status will be determined. If upon Aerotech's examination a warranted defect exists, then the product(s) will be repaired at no charge and shipped, prepaid, back to the buyer. If the buyer desires an airfreight return, the product(s) will be shipped collect. Warranty repairs do not extend the original warranty period.

Returned Product Non-warranty Determination

After Aerotech's examination, the buyer shall be notified of the repair cost. At such time, the buyer must issue a valid purchase order to cover the cost of the repair and freight, or authorize the product(s) to be shipped back as is, at the buyer's expense. Failure to obtain a purchase order number or approval within (30) days of notification will result in the product(s) being returned as is, at the buyer's expense. Repair work is warranted for (90) days from date of shipment. Replacement components are warranted for one year from date of shipment.

Rush Service

At times, the buyer may desire to expedite a repair. Regardless of warranty or out-of-warranty status, the buyer must issue a valid purchase order to cover the added rush service cost. Rush service is subject to Aerotech's approval.

On-site Warranty Repair

If an Aerotech product cannot be made functional by telephone assistance or by sending and having the customer install replacement parts, and cannot be returned to the Aerotech service center for repair, and if Aerotech determines the problem could be warranty-related, then the following policy applies:

Aerotech will provide an on-site field service representative in a reasonable amount of time, provided that the customer issues a valid purchase order to Aerotech covering all transportation and subsistence costs. For warranty field repairs, the customer will not be charged for the cost of labor and material. If service is rendered at times other than normal work periods, then special service rates apply.

If during the on-site repair it is determined the problem is not warranty related, then the terms and conditions stated in the following "On-Site Non-Warranty Repair" section apply.

On-site Non-warranty Repair

If any Aerotech product cannot be made functional by telephone assistance or purchased replacement parts, and cannot be returned to the Aerotech service center for repair, then the following field service policy applies:

Aerotech will provide an on-site field service representative in a reasonable amount of time, provided that the customer issues a valid purchase order to Aerotech covering all transportation and subsistence costs and the prevailing labor cost, including travel time, necessary to complete the repair.

Company Address

Aerotech, Inc.
101 Zeta Drive
Pittsburgh, PA
15238-2897

Phone: (412) 963-7470

Fax: (412) 963-7459

Appendix B: Technical Changes

Table B-1: Current Changes (1.01.00)

Section(s) Affected	General Information
Section 1.3.	Added section
Section 3.1.	Added section
Chapter 2: Installation, Section 2.1. , and Section 1.2.	Added safety information and warnings
Section 3.2.	Updated stage specifications
Section 3.2.	Added motor specifications

Table B-2: Archived Changes

Revision	Section(s) Affected	General Information
1.00.00	--	New manual

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Reader's Comments

ABL/ABLH9000 Series Stage Manual **P/N: EDS104, February 28, 2011** **Revision 1.01.00** Please answer the questions below and add any suggestions for improving this document.	

Is the manual:	Yes	No
Adequate to the subject		
Well organized		
Clearly presented		
Well illustrated		

How do you use this document in your job? Does it meet your needs? What improvements, if any, would you like to see? Please be specific or cite examples.

	Stage/Product Details		Name	
Model #			Title	
Serial #			Company Name	
Date Shipped			Address	
Customer Order #				
Aerotech Subsidiary Order #			Email	

Mail your comments to:	**Fax to:**
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